

HYBRIDISATION OF BIRDWING BUTTERFLIES (LEPIDOPTERA : PAPILIONIDAE) IN PAPUA NEW GUINEA

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ABSTRACT

Female butterflies of *Ornithoptera priamus urvilliana* Guérin-Ménéville, bred from pupae imported from Bougainville, were released in a garden at Sogeri, Papua New Guinea (9°25'S, 147°25'E) where *O.p. poseidon* Doubleday occurred in all its stages naturally. This resulted in many hybrids of both sexes. Later, in the same garden, adults of both sexes of *Troides oblongomaculatus papuensis* Wallace, obtained from pupae introduced from Lae (6°44'S, 147°00'E) were also released and after a small colony of this species had established itself several matings of both sexes of *O.p. poseidon* and *T. oblongomaculatus papuensis* were observed and subsequently one male hybrid specimen was reared.

INTRODUCTION

In 1971, cuttings of *Aristolochia schlechteri* Laut. were planted at Sogeri (9°25'S, 147°25'E), commenced vegetative growth and after about one year developed a lush growth of leaves and young shoots. The nearest natural habitat to Sogeri of this plant is a generally low and heavily forested area, about 25 km distant, where it is the hostplant of both *Ornithoptera meridionalis* Rothschild and *O. priamus poseidon* Doubleday. This plant has not been found in the Sogeri area, and since its introduction no females of *O. p. poseidon* have been observed to oviposit on it. In September 1975, between 25 and 30 female butterflies of *O.p. urvilliana* Guérin-Ménéville obtained from pupae imported from Bougainville, were released at Sogeri in the same area where *O.p. poseidon* occurred throughout the year and where early stages were found on several species of *Aristolochia*, the most widely distributed being *A. tagala* Cham.

HYBRIDS BETWEEN *ORNITHOPTERA PRIAMUS POSEIDON* AND *O. P. URVILLIANA*

Several released *O. p. urvilliana* females were seen to be mated by wild *O. p. poseidon* males and later, oviposition on both *A. tagala* and *A. schlechteri* occurred. The latter behaviour being remarkable as this plant is not known to occur in the natural habitat of *O. p. urvilliana*. The mortality of the hybrid larvae hatched from eggs laid on *A. schlechteri* was rather high; at least two-thirds or more perished during their 1st to 3rd instars. It is possible that their mouthparts were not well adapted to the coarse leaves and stems of *A. schlechteri*.

The surviving specimens developed normally, although rather slowly and many passed through 6 instead of the normal 5 instars. Sixth instar larvae developed relatively large heads with strong mandibles, while body sizes did not increase significantly beyond the normal size of 5th instar larvae of the species. Average length of the body was approximately 100 mm, which is similar to the average length of mature 5th instar larvae of both parent subspecies; average head capsule dimensions of some larvae are shown in Table 1.

Durations of early stages of hybrid larvae are shown in Table 2.

Table 1. Head capsule dimensions of some *O. priamus* larvae.

Taxon	Larval instar	No. of specimens measured	Average head capsule dimensions (mm)	
			Length	Width
<i>O. p. poseidon</i>	5	4	7.5	6.5
<i>O. p. urvilliana</i>	5	4	8.5	7.5
<i>O. p. poseidon</i> × <i>O. p. urvilliana</i>	6	3	11	10

Larvae of the maternal subspecies (*O. p. urvilliana*) have been described (e.g. Straatman, 1969). The hybrid larvae were likewise similar, having an almost black groundcolour and the dorsal tubercles were bright red for about 3/4 of the length, with the exception of the 2 dorsal tubercles on abdominal segment 4 which were creamy white tipped with light red. The pupae were generally darker than those of the 2 parent forms. The colour of the hybrid male butterflies was intermediate between males of the parent subspecies, with blue-green markings similarly placed to those of *O. p. urvilliana*; they strongly resembled the race *O. p. miokensis* Ribbe (Schmid, 1973), and did not vary greatly. Female hybrid butterflies showed considerable variation

Table 2. Duration in days of early stages of *O. p. poseidon* × *O. p. urvilliana*

Instar	Larval foodplant	
	<i>A. tagala</i>	<i>A. schlechteri</i>
1	2 to 3	3
2	3	4 to 5
3	4	6 to 8
4	6 to 7	9 to 12
5	10 to 12	15 to 18
6	no recordings	23 to 28
Prepupa	2	2
Pupa	28 to 32	32 to 35
Total (aver.)	60	100

especially in the hindwing markings which although brighter, were similar to those of the female parent (*urvilliana*). Females of *O. p. poseidon* have dark red lateral thoracic hair, while that of *O. p. urvilliana* is deep pink to light red. In this respect the hybrid females also resembled their maternal parent. The F₁ hybrid adults, of which many specimens were seen in the field, proved fertile and continued to reproduce, but with each following generation fewer males showed bluish markings and within 5 months after the F₁ generation only a few individuals showed any resemblance to *O. p. urvilliana*.

COURTSHIP AND MATING BEHAVIOUR BETWEEN *TROIDES OBLONGOMACULATUS PAPUENSIS* AND *ORNITHOPTERA PRIAMUS POSEIDON*, RESULTING IN A HYBRID BUTTERFLY.

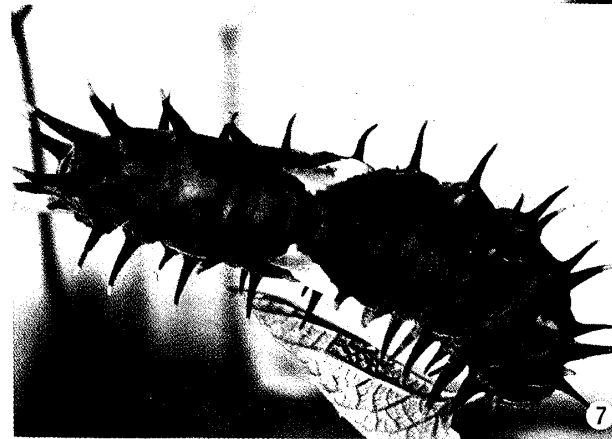
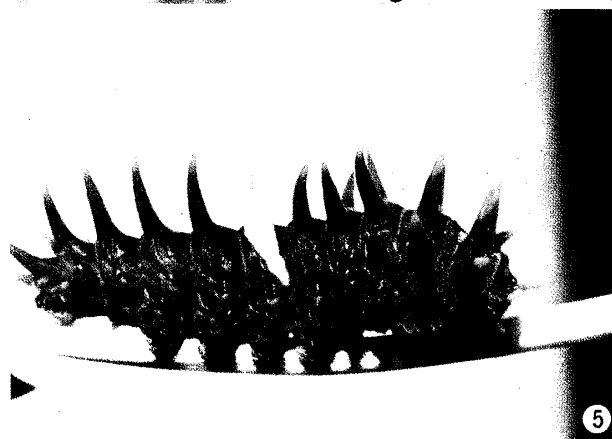
Sands and Sawyer (in press) report a mating in the wild between a male *Troides oblongomaculatus papuensis* and a female *Ornithoptera priamus poseidon*, from which 2 adult male hybrids were bred in captivity. In the remainder of this paper the foregoing taxa will be abbreviated as "Ob" and "Pos" respectively.

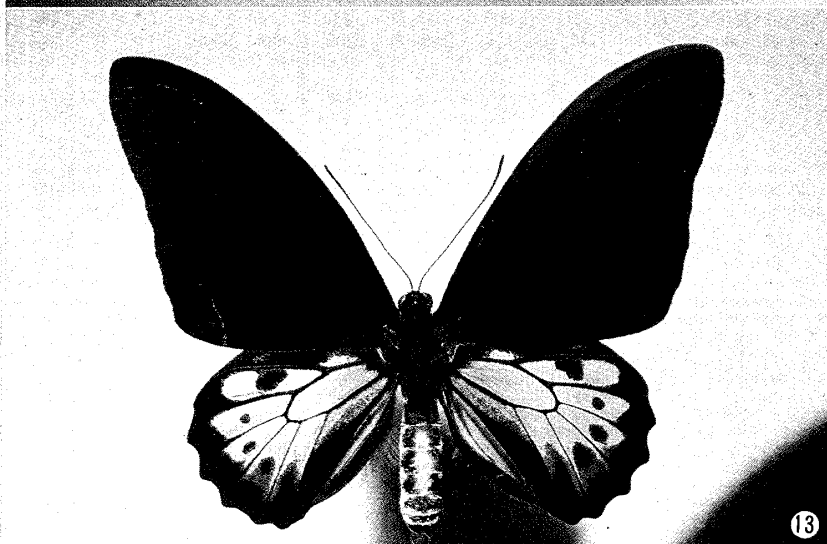
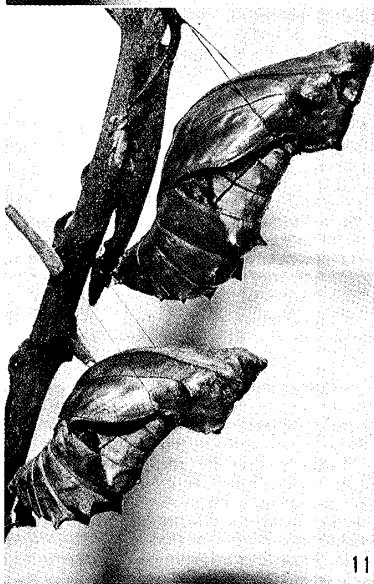
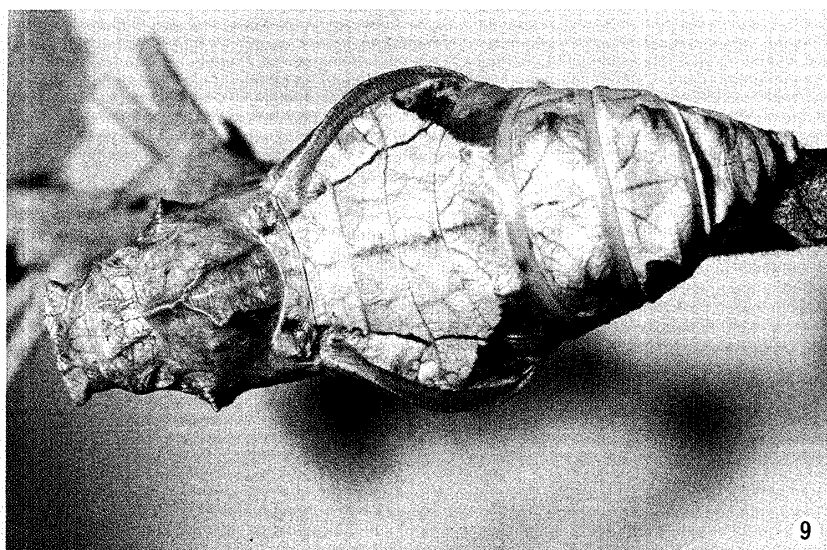
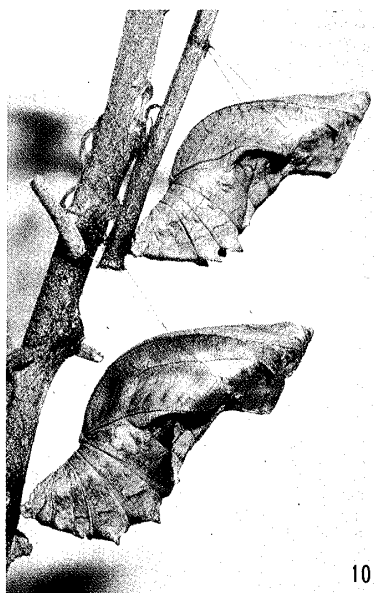
In the before mentioned area at Sogeri, *Aristolochia* foodplants together with many flowering shrubs supported a resident population of Pos in all stages. Ob had never been observed in or near the garden although present at a distance of approximately 5 km in small numbers.

Pupae of this butterfly were imported from Lae and the resulting adults were released in the garden, where they established a small population living side by side with Pos. Soon matings of both sexes of the 2 species were observed.

Courtship behaviour between Pos males and Ob females.

As seems to be common behaviour in birdwings, males of Pos searched the vicinity of their





hostplants for freshly emerged females, generally between 0700 and 1000 hours depending on weather conditions. Frequent observations revealed that Pos males after detecting a virgin female, approached it and mated immediately; the copulation usually lasted for about 6 hours. When no females of their own species were available some Pos males were attracted to fresh Ob females, and mating sometimes followed. Many Ob females resisted the attempts of the Pos males by covering their abdomen with their forewings or by dropping to the ground, making it thus impossible for the males to copulate. Only the very fresh Ob females with unhardened wings did not resist the approaching Pos male and, provided the latter were not too large, successful mating could occur. It was observed that when several Pos males appeared simultaneously in search of females, only worn, old specimens were attracted to the Ob females and attempted to mate. Fresher males, after hesitating briefly near such females, flew away without the slightest attempt to mate. It appeared that males were attracted visually (Common & Waterhouse, 1972 p. 41) by a female, but which factors encouraged certain males to copulate with a female not of their own kind, remained uncertain.

At 0830 hours one day, 2 virgin Ob females were placed near their foodplants in the garden, where at that time several Pos males were seen searching for fresh females. When next observed at about 0900 hours both Ob females were in copula with worn males of Pos. Between 1500 and 1530 hours both Pos males disengaged and the two females were taken indoors. Examination of their genitalia revealed a rather large portion of the male spermatophore protruding from the abdomen. Apparently Ob females have a smaller spermatheca than Pos females, which explains why only part of the Pos spermatophore could be stored; the protruding ends soon dried and broke free. The 2 females were kept in separate boxes and fed daily with a sucrose/honey solution, and after 8 days they were released in large (50×50×60cm) separate cages in which cut stems of *A. tagala* were placed.

One female lived for 12 days and deposited 19 eggs, the other female produced 5 eggs during a life of 6 days.

From the total of 24 eggs obtained, 4 darkened after 8 days, at which time warm breath blown over the eggs induced movement of the embryo, but only one larva hatched successfully; the other 3 perished inside the eggshell, possibly lacking sufficient strength to hatch. The surviving larva died about 6 hours after hatching, having partially devoured its eggshell.

Male courtship behaviour of Ob

Sexual behaviour of Pos males differed greatly from that of Ob males. When sighting a fresh female, Pos males did not display any courtship but approached the female directly and copulated; an Ob male detecting a fresh female of the same species, approached it and after careful examination commenced hovering about 20 to 30 cm directly above the female, displaying the bright yellow markings of the hindwings. Its forewings fluttered very rapidly while at the same time its hindwings moved forward, exposing the abdomen and the pouches in the anal fold of the hindwings for a fraction of a second with each forward motion, and at the same time displaying the androconial hairtufts.

This process lasted from 20 to 30 seconds, after which the male lowered itself to the female and attempted copulation. If the female was the same species, generally not more than one hovering flight occurred before successful mating ensued. If the female was Pos the first mating attempt was successful only if the female was very freshly emerged; some older females having hardened wings resisted mating attempts by dropping to the ground. In other cases the female responded favourably after the male had made 3 or 4 hovering flights. It was observed several times that males, apparently exhausted after several unsuccessful courtship flights came to rest on the abdomen or on a wing of the suspended female and stayed there for several minutes before they either resumed display flight or flew away. One morning 2 Pos and one Ob females, freshly emerged in captivity, were carried to the garden and suspended from a branch in the vicinity of some *A. tagala* hostplants. The Ob female was placed between the 2 Pos females, the distance between each specimen being approximately 20 cm. (Fig. 1 & 2). First 3 Ob males appeared simultaneously; one of them approached each of the 3 females in turn but failed to be attracted by any of these and flew off. Another male, a small and worn specimen, first inspected each of the 3 females then returned to the 1st Pos female and successfully copulated after its first hovering flight. This pair was then placed in a dark box at 0900 hours. Subsequently 2 more Ob males had arrived, one of these, a large fresh individual approached the Ob female and mated after its first hovering flight. At the same time (0930 hours) the third male, a very small and worn specimen, started courting the remaining Pos

female. After 2 long hovering flights it mated and was left undisturbed in the garden (Fig. 3). During the time of these observations no Pos males were seen. The caged pair was retained for further observations and separated at 1315 hours. Examination of the female genitalia showed a small part of the male spermatophore protruding from the abdomen. At 1400 hours the pair previously left in the garden remained in copula but when by 1500 hours the female was found alone and when examined was found to be fertilised successfully. Both fertilised specimens were kept in separate containers and fed daily with a weak sucrose/honey solution. After 10 days of this treatment, each female was released into cages as previously described for Ob females. Fecundity and fertility of each female is shown in Table 3.

Less than a week later a 3rd Pos female was mated successfully with an Ob male and held in captivity where it laid only 3 eggs over a period of 7 days; 2 of these eggs developed embryos which failed to hatch.

The previously hatched larva was kept indoors and developed finally into an adult male.

Description of early stages.

1st instar larva. Groundcolour dark brown, except the 3 last abdominal segments which were yellowish brown. All spines black, fleshy base of tubercles dark brown except the 2 dorsal reddish ones on abdominal segment 4. General appearance intermediate between the 2 parent species.

2nd instar (Fig. 4). Groundcolour dull reddish brown. All tubercles fleshy, dark brown, blunt, shorter than in Pos but longer than in Ob, the 2 dorsal ones on abdominal segment 4 pinkish red.

3rd instar. Groundcolour blackish brown. Abdominal segment 4 with a faint, yellowish lateral stripe, its 2 dorsal tubercles light pinkish red, all other tubercles tipped orange-yellow. All segments with faint dark triangular stripes dorsally.

4th instar (Fig. 5). Groundcolour reddish black. Tubercles longer and more pointed; on abdominal segment 4, lateral stripe white, 2 dorsal tubercles pink tipped.

5th instar. (Fig. 6 & 7). Groundcolour almost black. Dorsally with lighter triangular markings, as in Ob. On abdominal segment 4, lateral stripe white, 2 dorsal tubercles white with pink tips. All other tubercles dark brown, tipped orange. General appearance as in Pos.

Pupa: (Fig. 8 & 9). Intermediate between the 2 parent species but resembling Ob more than Pos. Wingcases broad, body comparatively short. Abdominal segments 5 to 7 each with 2 dorso-lateral humps, those on segment 5 very short, the others broad and blunt as in Ob. Groundcolour mottled yellowish brown, dorsal saddle mark as in Pos, yellow with dark edges, divided by 2 dorso-lateral dark brown stripes.

Table 4. Duration in days of early stages were:

	days
egg	12
1st instar	4
2nd instar	4
3rd instar	7
4th instar	6
5th instar	9
prepupa	2
pupa	29
total :	73 days

are pinkish fawn with black scaling.

Adult hybrid specimen, its exuviae and parent butterflies lodged in the A.N.I.C., Canberra, Australia.

Table 3. Fecundity and fertility of Pos females mated by Ob males

Total number of eggs laid	female No. 1 40	female No. 2 26
eggs showing embryo which failed to hatch	none	4
larvae hatched	none	one
total number of days of oviposition	26	17

Adult Male (Fig. 12, 13 & 14)

Generally similar to that of the paternal taxon, but showing the influence of the maternal pattern of the forewing underside, as in the hybrid between *Papilio aegaeus aegaeus* and *P. fuscus capaneus* (Straatman, 1962), it has a row of black submarginal spots and some greenish scales margining the yellow areas on both surfaces of the hindwing and has the lateral and ventral parts of the abdomen bright yellow. Neither the red collar of Ob nor the green dorsal thoracic stripe of Pos is present. The black terminal margin of the hindwing is only about 1/3 as broad as in Ob, and the scent pouch is of dark groundcolour and much less densely haired than in that species. On the other hand, the base of the cell is quite densely haired compared with that of Ob. The claspers

DISCUSSION

The production of adult hybrids between *Troides oblogomaculatus papuensis* and *Ornithoptera priamus poseidon* from matings observed in the field (Sands and Sawyer, in press) and under the partially controlled conditions as described in this study suggests that hybridisation between sympatric birdwing taxa may occur more frequently than has usually been supposed. Successful development of adult hybrids would be favoured if both parent species shared the same larval foodplant, although successful development of birdwing larvae on foodplants not known to be utilised by the parent populations has been recorded for *O. alexandrae* Rothschild, (Straatman, 1971), *O. goliath* Oberthür (Straatman, 1974) and in the present study for *O. p. poseidon* × *O. p. urvilliana*. The foregoing observations add considerable weight to the view that *O. allotiei* Rothschild is actually a hybrid between *O. p. urvilliana* and *O. victoriae regis* Gray (Rousseau-Decelle 1939, McAlpine 1970) which are sympatric, relatively common, and share the same larval foodplant in the habitat of the putative species.

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- Fig. 1. Male of Ob hovering over female of Pos.
- Fig. 2. Male of Ob approaching female of Pos.
- Fig. 3. Ob (male) in cop. with Pos (female).
- Fig. 4. Hybrid Ob (male) × Pos (female), 2nd instar.
- Fig. 5. same, 4th instar.
- Fig. 6. same, 5th instar, lateral.
- Fig. 7. same, 5th instar, dorsal.
- Fig. 8. Hybrid pupa, lateral.
- Fig. 9. Hybrid pupa, dorsal.
- Fig. 10. top:Ob pupa. bottom : Hybrid pupa.
- Fig. 11. top: Pos pupa. bottom : Hybrid pupa.
- Fig. 12. Hybrid adult, male.
- Fig. 13. Hybrid adult, dorsal.
- Fig. 14. Hybrid adult, ventral.